

Remarks

Rejections Under 35 USC §102 and §103

Claims 34, 38-39, 43, 49 and 51 have been rejected under 35 USC §102(b) as being anticipated by Fjelstad et al (US Patent No. 5,632,631).

Claim 38 has been rejected under 35 USC §103(a) as being unpatentable over Fjelstad et al. (US Patent No. 5,632,631) in view of Sugiyama et al. (US Patent No. 4,766,666).

Claims 40-41 and 50 have been rejected under 35 USC §103(a) as being unpatentable over Fjelstad et al. (US Patent No. 5,632,631) in view of Kazle (US Patent No. 5,936,847).

Argument

In response to the rejections, independent claims 34, 39 and 49, and dependent claims 38, 40 and 41, have been amended to recite features which further distinguish the claimed method from the prior art. These features, in combination with other recited steps and features, are submitted to define a method which is both novel and unobvious over the prior art.

As requested in the Office Action, a reading of the amended claims on the drawings and specification is as follow.

34. A method for fabricating an interconnect (**10-Figure 1, page 9, lines 6-30**) for electrically engaging a semiconductor component (**18-Figure 2C page 9, lines 6-30**) having at least one bumped contact (**16-Figure 2C page 9, lines 6-30**) comprising:

providing a substrate (**14B-Figure 7A, page 18, line 33 to page 19, line 3**) having a surface (**26B-Figure 3C**);

forming a plurality of leads (**22B-Figure 7C, page 19, lines 10-14**) on the surface (**26B-Figure 3C**) configured to

electrically engage and support the bumped contact (**Figure 3B, page 4, lines 18-21**), the leads having terminal portions (**30A-Figure 2B, page 10, line 33**) and support portions (**32A-Figure 2A, page 11, lines 1-3**);

forming a recess (**20B-Figure 7F, page 21, lines 10-14**) in the surface configured to cantilever the terminal portions over the recess with the support portions on the surface supporting the terminal portions (**page 11, lines 3-5**) for movement within the recess during electrical engagement of the bumped contact (**page 12, lines 2-5**), the recess sized and shaped to retain and center the bumped contact during the electrical engagement (**page 11, lines 27-28**), the recess having a diameter (**D-Figure 2B**) approximately equal to that of the bumped contact (**page 11, lines 29-31**) and a depth (**X-Figure 2B**) approximately equal to a height of the bumped contact (**page 12, lines 5-7**).

35. The method of claim 34 further comprising forming outer layers (**46B-Figure 7B and 3D, page 19, lines 4-9 of the specification**) on the terminal portions configured to provide a non bonding surface for the bumped contact.

38. The method of claim 34 wherein the substrate comprises a semiconductor material (**page 10, line 4**), the forming the recess step comprises anisotropic etching (**page 16, line 30**), and the recess has straight sidewalls sloped at an angle of about 55° with respect to the surface (**page 16, lines 26-28**).

39. A method for fabricating an interconnect (**10-Figure 1, page 9, lines 6-30**) for electrically engaging a semiconductor component (**18-Figure 2C page 9, lines 6-30**) having at least one bumped contact (**16-Figure 2C page 9, lines 6-30**) comprising:

providing a substrate (**14B-Figure 7A, page 18, line 33 to page 19, line 3**) having a surface (**26B-Figure 3C**);

forming a metal layer (leads 22B-Figure 7C, pag 19, lines 10-14) on the surface (26B-Figure 3C);

forming a plurality of leads (leads 22B-Figure 7C, page 19, lines 10-14) on the substrate configured to electrically engage and support the bumped contact (Figure 3B, page 4, lines 18-21), the leads having terminal portions (30A-Figure 2B, page 10, line 33) with the projections thereon and support portions (32A-Figure 2A, page 11, lines 1-3);

etching a recess (20B-Figure 7F, page 21, lines 10-14) in the surface configured to cantilever the terminal portions over the recess with the support portions on the surface supporting the terminal portions (page 11, lines 3-5) for movement within the recess during electrical engagement of the bumped contact (page 12, lines 2-5), the recess having shaped sidewalls (page 16, lines 25-34) configured to retain and center the bumped contact during the electrical engagement (page 11, lines 27-28).

40. The method of claim 39 wherein the etching step comprises anisotropic etching and the sidewalls are sloped at an angle with respect to the surface (page 16, lines 25-28).

41. The method of claim 39 wherein the etching step comprises isotropic etching and the sidewalls are curved (page 16, lines 31-34).

43. The method of claim 39 further comprising forming a connecting segment (40B-Figure 7F, page 19, lines 11-14) on the substrate electrically connecting the leads, a conductive via (42B-Figure 7E, page 19, line 15 to page 20, lin 31) in the substrate in electrical communication with the connecting segment and a contact (38B-Figure 7F, page 20, line 32 to page 21, line 9) on the substrate in electrical communication with the conductive via.

49. A method for fabricating an interconnect (10-Figure 1, page 9, lines 6-30) for electrically engaging a semiconductor component (18-Figure 2C page 9, lines 6-30) having a plurality of bumped contacts (16-Figure 2C page 9, lines 6-30) on comprising:

providing a substrate (14B-Figure 7A, page 18, line 33 to page 19, line 3);

forming a plurality of interconnect contacts (14B-Figure 7G, page 18, line 2 to page 21 line 20) on the substrate configured to electrically engage the bumped contacts (page 9, line 26), each interconnect contact comprising a plurality of leads (leads 22B-Figure 7C, page 19, lines 10-14) having terminal portions (30A-Figure 2B, page 10, line 33) and projections (blades 28B-Figure 7B, page 19, lines 4-5 described as projections on page 4, line 25) on the terminal portions;

forming a plurality of recesses (20B-Figure 7F, page 21, lines 10-14) in the substrate proximate to the leads configured to cantilever the terminal portions of the leads for movement within the recesses during the electrical engagement (page 12, lines 2-5), the recesses configured to retain and center the bumped contacts during the electrical engagement (page 11, lines 27-28), each recess having a diameter (D-Figure 2B) approximately equal to that of a bumped contact (page 11, lines 29-31) and a depth (X-Figure 2B) approximately equal to or less than a height of the bumped contact (page 12, lines 5-7); and

forming outer layers (46B-Figure 7B and 3D, page 19, lines 4-9) on the terminal portions and projections configured to provide non-bonding surfaces for the bumped contacts (page 13, line 27, to page 14, line 2).

50. The method of claim 49 wherein the outer layers comprise a conductive polymer (page 14, lines 1-2 of the specification).

51. The method of claim 49 wherein the projections comprise blades (**blades 28B-Figure 7B, page 19**).

With respect to the claim amendments, amended independent claim 34 recites "the recess sized and shaped to retain and center the bumped contact during the electrical engagement". Amended independent claim 34 also recites "the recess having a diameter approximately equal to that of the bumped contact and a depth approximately equal to a height of the bumped contact." Antecedent basis for these recitations is contained on page 11, lines 27-31 of the specification. In addition, the retaining and centering function of the recess 20B is shown in Figure 3B.

As shown in Figure 3 of Fjelstad et al., the recesses (holes 46) for the leads (contacts 20) are substantially larger than the bumped contacts (leads 72) on the component (microelectronic element 70). In addition, the recesses (holes 46) are not shaped to perform a retaining and centering function. In contrast, with the present method the shaped sidewalls of the recess 20B are sloped during fabrication to retain and center the bumped contact 16 during use. This feature is particularly advantageous for retaining and centering the bumped contacts 16, when there is misalignment between the substrate 12B (Figure 3B) and the component 18 (Figure 3B). This feature is also useful for compensation for individual variations in the size and locations of the bumped contacts 16.

Amended independent claim 39 recites "the recess having shaped sidewalls configured to retain and center the bumped contact during the electrical engagement". Amended dependent claim 40 recites "the etching step comprises anisotropic etching and the sidewalls are sloped at an angle with respect to the surface". Amended dependent claim 41 recites "the etching step comprises isotropic etching and the sidewalls are curved". Antecedent basis

for these recitations is contained on page 16, lines 25-33 of the specification. The etching step in the method of claims 39-41 shapes the recess such that it can perform a retention and centering function during use as previously described.

Although both anisotropic and isotropic etching of a semiconductor substrate are known in the art, the present method uses etching in combination with cantilevered lead formation to provide an improved contact for bumped semiconductor components. In regard to the recess etching step, Sugiyama et al. was cited as teaching anisotropic etching. However, the etching procedures in Fjelstad et al. are all performed on metal features, such that there would be no incentive to use anisotropic etching in the Fjelstad et al. connector.

In support of the proposed combination of Fjelstad et al. and Sugiyama et al. the Office Action states:

"It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Fjelstad by providing a semiconductor material and anisotropic etching, as taught by Sugiyama, for the purpose of electrically communicating between two surfaces using the semiconductive material instead of metal and the anisotropic etching allows one side etching to form recesses."

However, Applicant is unable to ascertain which two surfaces, and which metal conductors, could be replaced in Fjelstad et al. by an anisotropic etching step. Although the above quoted statement from the Office Action was submitted as a justification for the proposed combination, there would be no reason to substitute semiconductor materials for the metal layers in the Fjelstad et al. connector. In this regard, semiconductor materials do not have the same conductivity as metals, and can be more difficult to shape and insulate than metals.

Amended independent claim 49 recites "the recesses configured to retain and center the bumped contacts during the electrical engagement, each recess having a diameter approximately equal to that of a bumped contact and a depth less than or equal to a height of the bumped contact". Antecedent basis for the "less than or equal" recitation is contained on page 12, lines 5-7 of the specification. The recess forming step provides an improved contact able to center bumped contacts on the component, while accommodating variations in the size and planarity of the bumped contacts. As previously argued, Fjelstad et al. taken alone or in combination, does not suggest such a recess forming step, nor a recess having the stated characteristics.

With respect to the rejections based on Kazle, this reference was cited as teaching a conductive polymer 140a, 140b on contacts 12a, 12b. However, the conductive polymer 140a, 140b in Kazle is intended to bond to the component contacts (note Figure 3 and column 4, lines 63-67 of Kazle). In contrast, independent claim 49 and dependent claim 45, recite the step of providing outer surfaces on the leads "configured to provide a non bonding surface for the bumped contact". The forming the non-bonding layer step of the present method is recited in the claims, but is not taught or suggested Kazle.

Conclusion


In view of the amendments and arguments, the rejections are submitted to have been overcome. Accordingly, favorable consideration and allowance of claims 34-35, 38-41, 43 and 49-51 is respectfully requested. In addition, with the allowance of independent

claims 34, 39 and 49, the rejoinder of withdrawn dependent claims 36, 37, 42 and 52 will be requested.

An Information Disclosure Statement is being filed concurrently with this Amendment. Should any issues arise that will advance this case to allowance, the Examiner is asked to contact the undersigned by telephone.

DATED this 30th day of April, 2004.

Respectfully submitted:



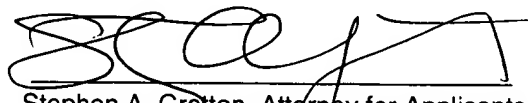
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